

WHAT IS CLAIMED IS:

1. A ferroelectric memory device comprising:
a semiconductor substrate;
5 a lower interlayer dielectric on the semiconductor substrate;
a plurality of ferroelectric capacitors on the lower interlayer dielectric; and
a plate line that extends across and electrically connects to surfaces of at least
two adjacent ones of the plurality of ferroelectric capacitors.
- 10 2. The device as claimed in claim 1, further comprising:
an upper interlayer dielectric on the lower interlayer dielectric and the
plurality of ferroelectric capacitors; and
hydrogen barrier spacers between sidewalls of the ferroelectric capacitors and
the lower interlayer dielectric.
- 15 3. The device as claimed in claim 2, wherein the hydrogen barrier spacers
are at least one from the group consisting of TiO_2 , Al_2O_3 , ZrO_2 , and CeO_2 .
- 20 4. The device as claimed in claim 2, wherein the plate line covers
sidewalls of the hydrogen barrier spacers and a surface of the lower interlayer
dielectric.
- 25 5. The device as claimed in claim 1, wherein the plate line comprises:
a local plate line directly contacting the surfaces of the at least two adjacent
ferroelectric capacitors; and
a main plate line on the upper interlayer dielectric opposite to the local plate
line and directly contacting a surface of the local plate line via a slit-type via hole
through the upper interlayer dielectric.
- 30 6. The device as claimed in claim 5, wherein the upper interlayer
dielectric is between the local plate line and main plate line.
7. The device as claimed in claim 1, wherein the plurality of ferroelectric
capacitors are arranged in rows and columns.

8. The device as claimed in claim 1, wherein sidewalls of the ferroelectric capacitors are substantially vertical relative to a top surface of the semiconductor substrate.

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9. The device as claimed in claim 8, wherein sidewalls of the ferroelectric have an inclination of about 70° to about 90° relative to a top surface of the semiconductor substrate.

10. The device as claimed in claim 1, wherein the ferroelectric capacitor comprises a lower electrode, a ferroelectric pattern, and an upper electrode, wherein the plate line directly contacts the upper electrodes of at least two adjacent ones of the plurality of ferroelectric capacitors.

11. The device as claimed in claim 10, wherein the lower electrode and the upper electrode comprise at least one of ruthenium and ruthenium oxide.

12. The device as claimed in claim 10, wherein the ferroelectric pattern comprises PZT(Pb, Zr, TiO₃) with PbTiO₃ as a seed layer.

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13. The device as claimed in claim 10, wherein the ferroelectric pattern is at least one material from the group consisting of SrTiO₃, BaTiO₃, (Ba, Sr)TiO₃, Pb(Zr,Ti)O₃, SrBi₂Ta₂O₉, (Pb,L_A)(Zr,Ti)O₃, and Bi₄Ti₃O₁₂.

14. The device as claimed in claim 1, wherein the plate line is at least one material from the group consisting of the platinum group including ruthenium, platinum, iridium, rhodium, Osmium, and palladium, and oxides thereof.

15. The device as claimed in claim 1, wherein the plate line is a local plate line directly contacting the surfaces of at least two adjacent ones of the plurality of ferroelectric capacitors, and further comprising an upper interlayer dielectric covering the local plate line.

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16. The device as claimed in claim 1, further comprising an upper

interlayer dielectric covering on the plurality of ferroelectric capacitors, and wherein the plate line is a main plate line directly contacting the surfaces of the at least two adjacent ones of the plurality of ferroelectric capacitors via a slit-type via hole penetrating the upper interlayer dielectric.

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17. The device as claimed in claim 1, further comprising an insulation pattern between the plate line and the lower interlayer dielectric.

10 18. The device as claimed in claim 17, wherein the insulation pattern is an upper interlayer dielectric.

19. The device as claimed in claim 1, further comprising an upper interlayer dielectric on the plurality of ferroelectric capacitors, and main word lines on the upper interlayer dielectric.

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20. A method of fabricating a ferroelectric memory device, comprising:
forming a lower interlayer dielectric on a semiconductor substrate;
forming a plurality of ferroelectric capacitors on the lower interlayer dielectric; and
20 forming a plate line that extends across and electrically connects to surfaces of at least two adjacent ones of the plurality of ferroelectric capacitors.

21. The method as claimed in claim 20, further comprising:
forming hydrogen barrier spacers between sidewalls of the ferroelectric
25 capacitors and the lower interlayer dielectric; and
forming an upper interlayer dielectric on the lower interlayer dielectric and the plurality of ferroelectric capacitors.

22. The method as claimed in claim 21, wherein the hydrogen barrier
30 spacers are formed from a material selected from one or more of the group consisting of TiO_2 , Al_2O_3 , ZrO_2 , and CeO_2 .

23. The method as claimed in claim 21, wherein the forming a plate line comprises forming the plate line on sidewalls of the hydrogen barrier spacers and a

surface of the lower interlayer dielectric.

24. The method as claimed in claim 21, wherein forming the plate line comprises:

- 5 forming a lower plate layer on the semiconductor substrate and the hydrogen barrier spacers; and
 patterning the lower plate layer to form a plurality of parallel local plate lines, wherein each of the local plate lines directly contacts surfaces of at least two adjacent ones of the plurality of ferroelectric capacitors.

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25. The method as claimed in claim 24, wherein prior to the forming the lower plate line, the method further comprises:

- forming an insulation layer on the semiconductor substrate and the hydrogen barrier spacers; and
15 planarizing the insulation layer until surfaces of the ferroelectric capacitors are exposed, and leaving an insulation pattern filling a gap region between the ferroelectric capacitors.

26. The method as claimed in claim 24, wherein after forming the local
20 plate line, the method further comprises sequentially forming a first upper interlayer dielectric layer and a second upper interlayer dielectric layer on the local plate lines.

27. The method as claimed in claim 26, further comprising:
 successively patterning the second and first interlayer dielectric layers to form
25 a slit-type via hole exposing a portion of the local plate lines; and
 forming a main plate line covering the slit-type via hole.

28. The method as claimed in claim 20, wherein forming a plurality of ferroelectric capacitors comprises:
30 sequentially forming a lower electrode layer, a ferroelectric layer, and an upper electrode layer on the lower interlayer dielectric; and
 successively patterning the upper electrode layer, the ferroelectric layer, and the lower electrode layer to form a plurality of stacked lower electrode, ferroelectric pattern, and upper electrode structures that are arranged in row and column directions.

29. The method as claimed in claim 28, wherein sidewalls of the ferroelectric capacitors have an inclination of about 70° to about 90°.

5 30. The method as claimed in claim 28, wherein the lower electrode layer and the upper electrode layer are formed from at least one of ruthenium and ruthenium oxides.

31. The method as claimed in claim 28, wherein successively patterning
10 the upper electrode layer, the ferroelectric capacitor layer, and the lower electrode layer comprises anisotropically etching using a plasma containing oxygen.

32. The method as claimed in claim 28, wherein the ferroelectric pattern is formed from at least one material in the group consisting of PZT(Pb, Zr, TiO₃),
15 SrTiO₃, BaTiO₃, (Ba, Sr)TiO₃, Pb(Zr,Ti)O₃, SrBi₂Ta₂O₉, (Pb,La)(Zr,Ti)O₃, and Bi₄Ti₃O₁₂, and wherein the ferroelectric pattern is formed using PbTiO₃ as a seed layer.

33. The method as claimed in claim 28, wherein the ferroelectric layer is
20 formed using a chemical solution deposition using a precursor of at least one of lead acetate[Pb(CH₃CO₂)₂·3H₂O], zirconium n-butoxide [Zr(n-OC₄H₉)₄], and titanium isopropoxide [Ti(i-OC₃H₇)₄], and using a solvent 2-methoxyethano [CH₃OCH₂CH₂OH].

25 34. The method as claimed in claim 21, wherein the forming the hydrogen barrier spacers comprises:

conformally forming a hydrogen barrier layer on the ferroelectric capacitors and the semiconductor substrate; and

anisotropically etching the hydrogen barrier layer until surfaces of the
30 ferroelectric capacitors are exposed,

wherein the hydrogen barrier layer is formed from at least one material selected from the group consisting of TiO₂, Al₂O₃, ZrO₂, and CeO₂.

35. The method as claimed in claim 21, wherein forming the upper

interlayer dielectric and the forming the plate line comprises:

sequentially forming first and second upper interlayer dielectrics on the hydrogen barrier spacers and the semiconductor substrate; and

- 5 successively patterning the second and first upper interlayer dielectrics to form a slit-type via hole exposing a surface of the ferroelectric capacitor in a row direction; and

forming a main plate line covering the slit-type via hole.

36. The method as claimed in claim 35, wherein the slit-type via hole
10 exposes a surface of the lower interlayer dielectric between the ferroelectric capacitors.

37. The method as claimed in claim 35, wherein the forming the slit-type via hole comprises leaving a portion of the first upper interlayer dielectric between the
15 hydrogen barrier spacers.

38. The method as claimed in claim 35, wherein the sequentially forming first and second upper interlayer dielectrics comprises forming main word lines between the first and second upper interlayer dielectrics.

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